Space Weather Technical Forecast

Issued on Sunday, 30 October 2022 at 12:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of further G1/Minor Storms days 1 and 2 (30 and 31 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the last 24 hours, with several low energy C-class flares observed. There are four numbered Active Regions on the visible disc. AR3135 in the northeast and AR3131 near centre disc are the two largest regions and the latter continues to develop, with significant symmetrical spots in both positive and negative polarities, and some development recently of intermediate spots. The former presents a large leader spot, with small, faint, trailer spots. AR3130 on the southwest limb and AR3133 in the northeast are both simplifying bipolar regions. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, observed by DSCOVR at L1, have been elevated around 540 km/s, peaking at 601 km/s at 29/1253 UTC. This is due to a connection with the high speed stream from coronal hole 36 and perhaps a concurrent connection with the high speed stream from coronal hole 37. Density was near average, with a peak of 15 ppcc at 30/0349 UTC. Total interplanetary magnetic field strength was weak below 7nT throughout. The north-south component, Bz, was also weak with values between +6/-7 nT, with a bias to negative Bz values. Geomagnetic activity started at Active (Kp4) levels becoming Quiet to Unsettled (Kp2-3) by period end. Phi angle remained predominantly positive (away from the Sun).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at mostly moderate levels with a peak to High values with 1.03e3 at 29/2035 UTC. Fluence levels have been background with an upward trend reaching 2.46e7 integrated pfu at 29/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low or Very Low, with a slight chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Earth is currently under the influence of a high speed stream related to coronal holes 36 and 37. A further high speed stream from coronal hole 38 is then likely to connect with Earth during this period. Elevated solar winds likely to continue with possibly Strong solar winds for a time. A declining trend is probable by day 3 (1 Nov). Geomagnetic activity is forecast to be Quiet to Unsettled (Kp2-3) with a chance of Minor Geomagnetic Storms (Kp5), especially on days 1 and 2 (30 and 31 Oct).

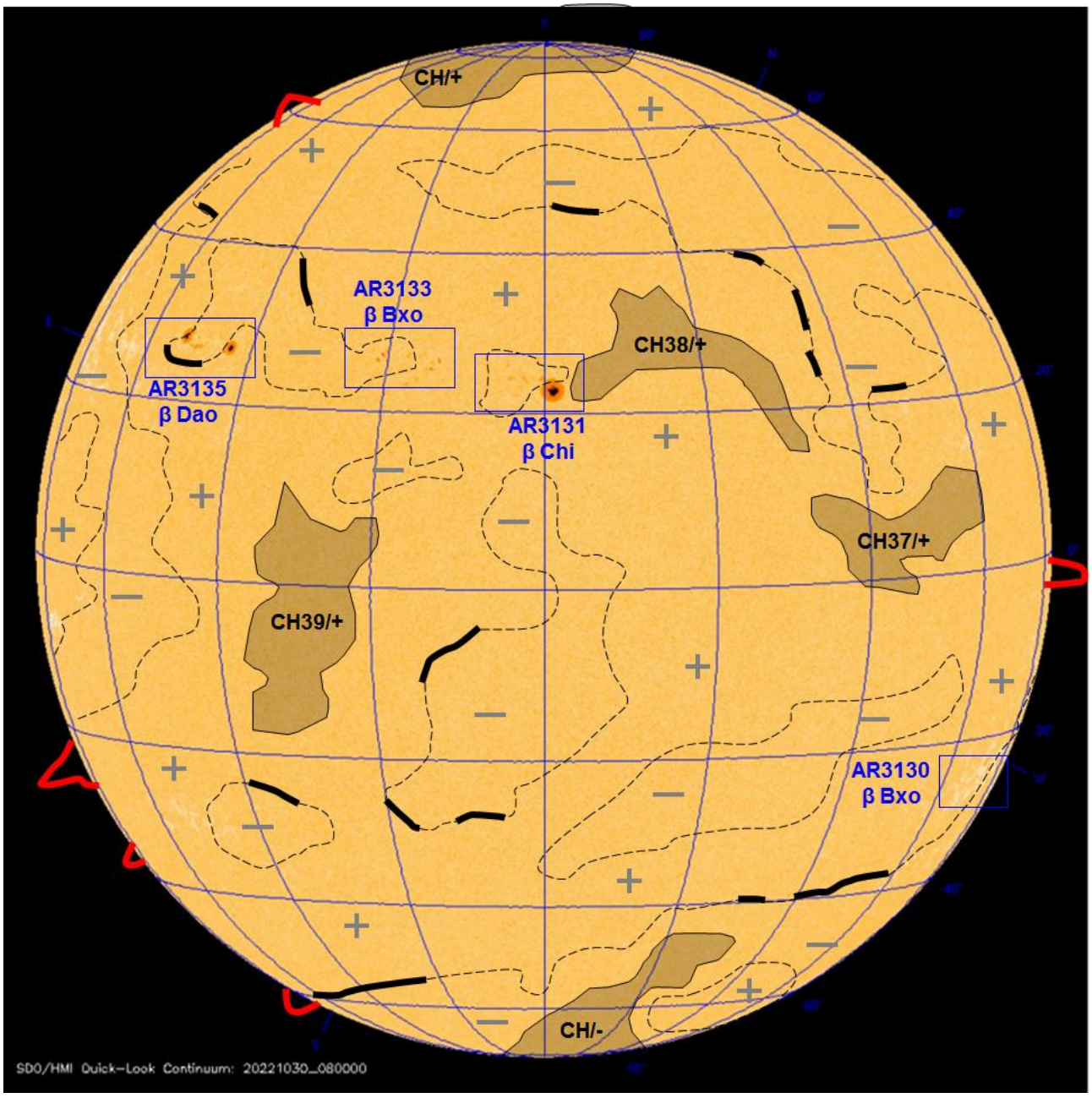
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at moderate levels, probably reaching high levels especially during the diurnal maximum on each day. The associated 24 hour electron fluence is expected to continue to increase, and likely to exceed the Active (1e8 integrated pfu) threshold by day 3 (1 Nov).

Figure 1. Solar Analysis Valid 0800UTC, 30 October 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

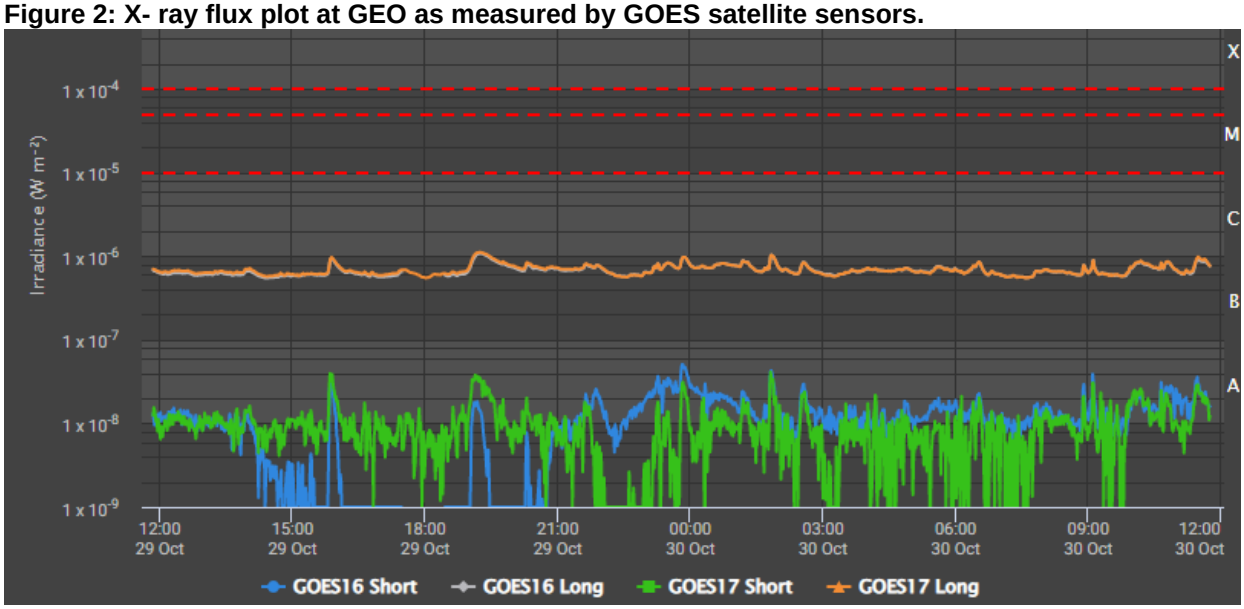
No Earth-directed CMEs are forecast.
The Earth is currently under the influence of the high speed stream from positive coronal holes 36 and 37, with current levels around 530 km/s. These coronal holes, in the northern hemisphere of the visible disc, along with the next coronal hole 38 feature in this forecast period. Based on observations from the last rotation where speeds of around 500 km/s were observed, and as these are all recurrent holes and appear stronger on this rotation, solar winds around 550 km/s are forecast throughout much of the forecast period, with a peak to Strong levels (600-650 km/s) possible for a time. However using recurrence as a guide, the peak speeds are likely to decline towards the end of the period.
Geomagnetic activity starting at Quiet to Unsettled (Kp2-3) levels during days 1 and 2 (30 and 31 Oct), with a chance of G1/Minor Storms at first, and this becomes a slight chance through the period given any sustained periods of negative Bz.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	20	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: X- ray flux plot at GEO as measured by GOES satellite sensors.



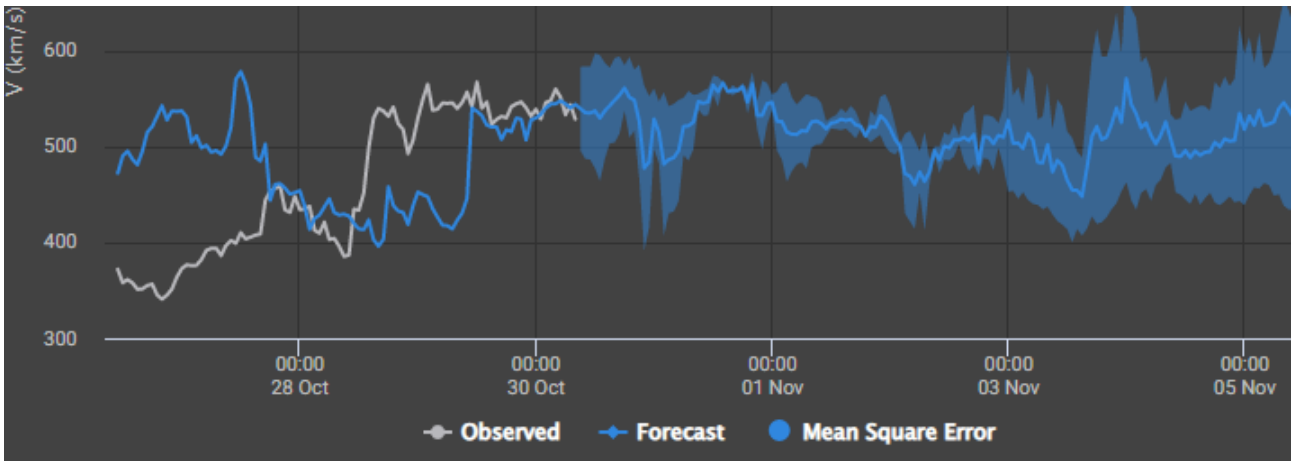
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
On the visible disc there are four numbered Active Regions. AR3135 in the northeast and AR3131 near centre disc are the two largest regions and the latter continues to develop, with significant symmetrical spots in both positive and negative polarities, and some development recently of intermediate spots. The former presents a large leader spot, with small, faint, trailer spots. AR3130 on the southwest limb and AR3133 in the northeast are both simplifying bipolar regions.
GONG far-sided imagery indicates a number of regions are forecast to rotate onto the visible disc from across the eastern limb through the forecast period, and this could further increase risk values.
Solar activity is likely to be Low or Very Low, with a slight chance of Moderate activity, mainly concentrated in the developing regions in the northeast quadrant.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	15	15	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Met Office Solar Winds Prediction Model (SWPM) indicating elevated levels.



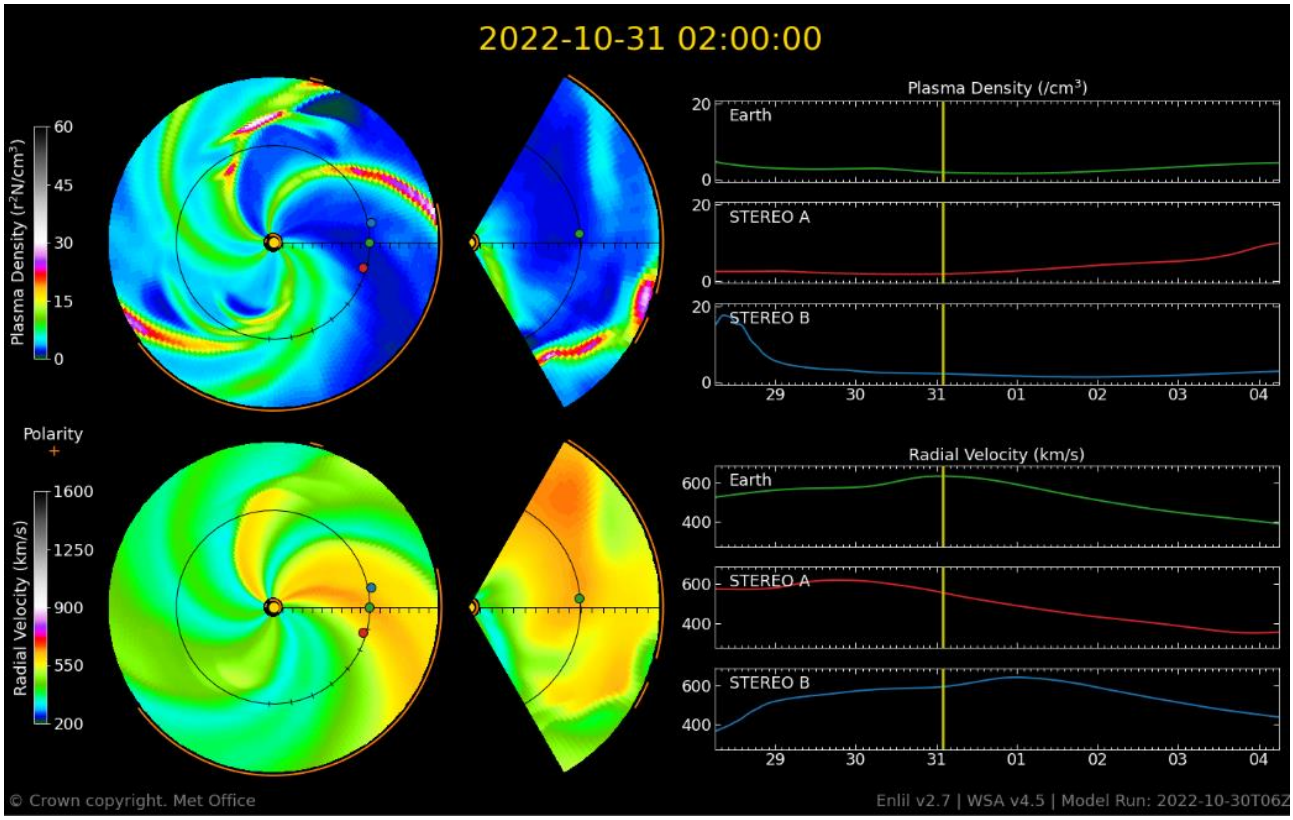
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background and is forecast to remain at this level through the guidance period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office ENLIL output with high speed streams affecting Earth for much of the period, with Strong (>600 km/s) forecast for a time.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at moderate levels, probably reaching high levels especially during the diurnal maximum on each day. The associated 24 hour electron fluence is expected to continue to increase, and likely to exceed the Active (1e8 integrated pfu) threshold by day 3 (1 Nov). Recurrence strongly favours this upward progression in activity with several days of active fluence observed, and Met Office REFM output also shows good guidance in this respect. The (1e9 integrated pfu) threshold is unlikely to be breached but probabilities in the table above have been raised to a slight chance to reflect the uncertainty.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	50	70	80
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	5	10

Figure 5: High energy electron flux (>2MeV) and Met Office REFM output showing an upwards trend.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.